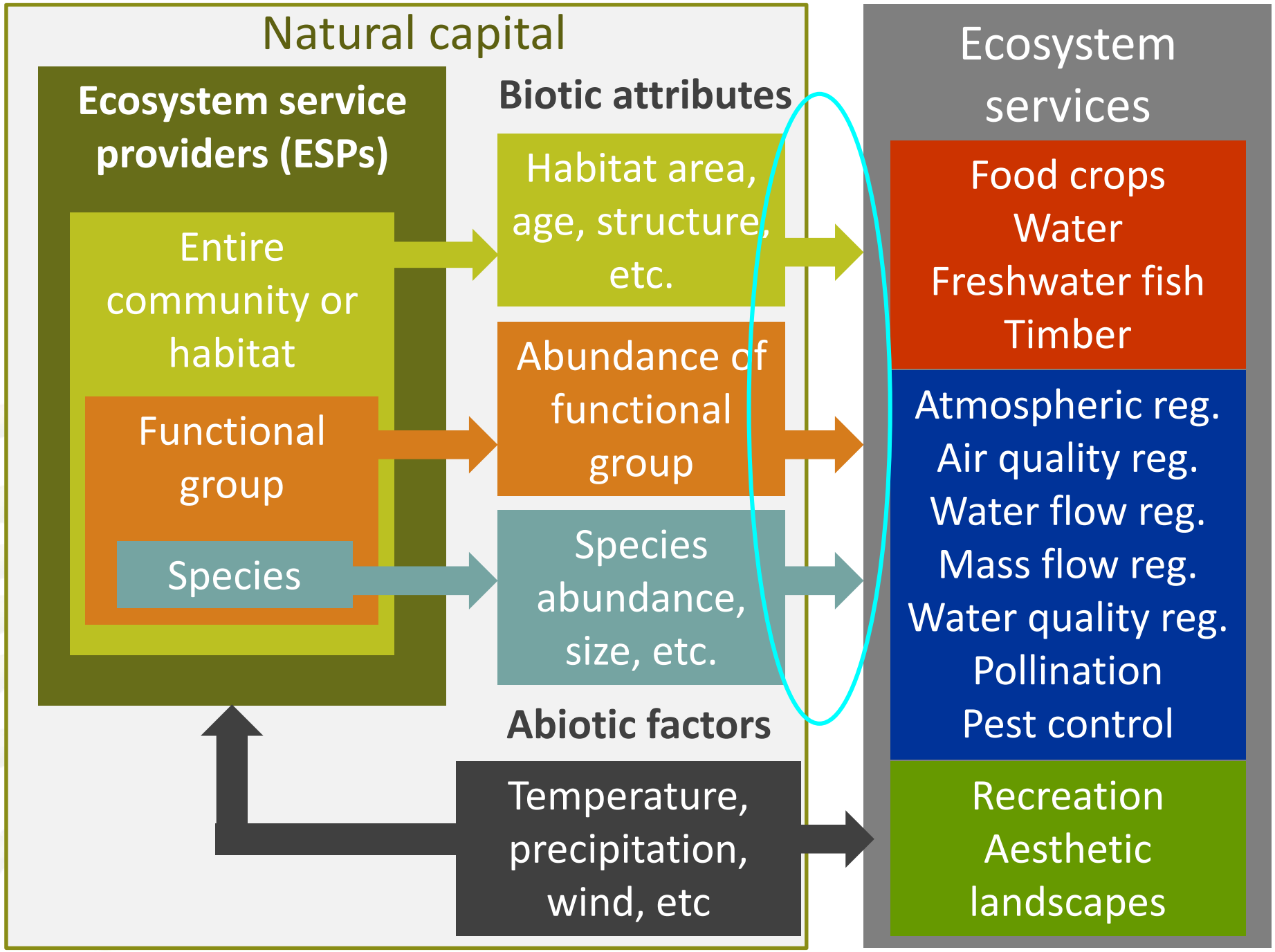
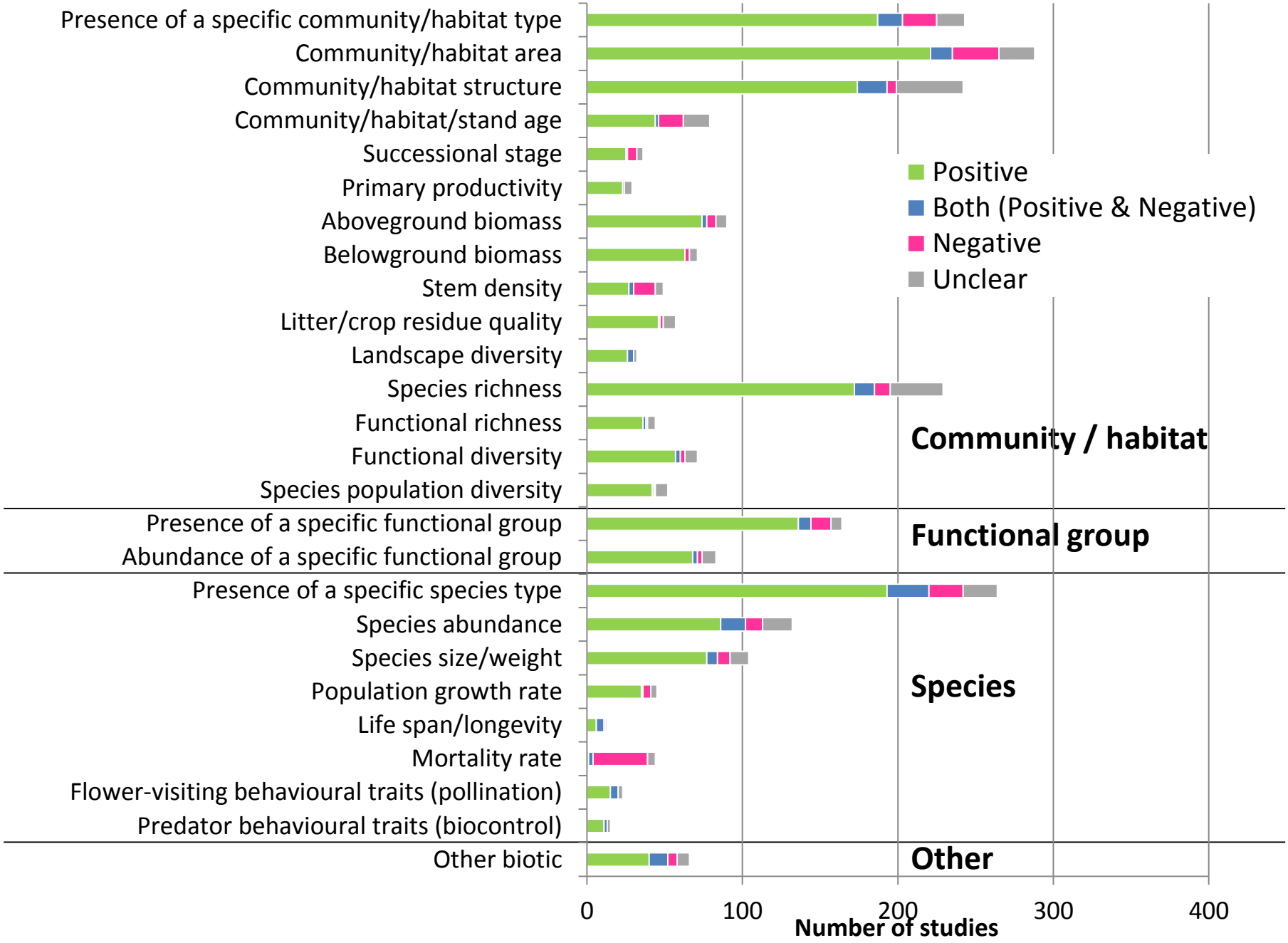
Links between natural capital and ecosystem services

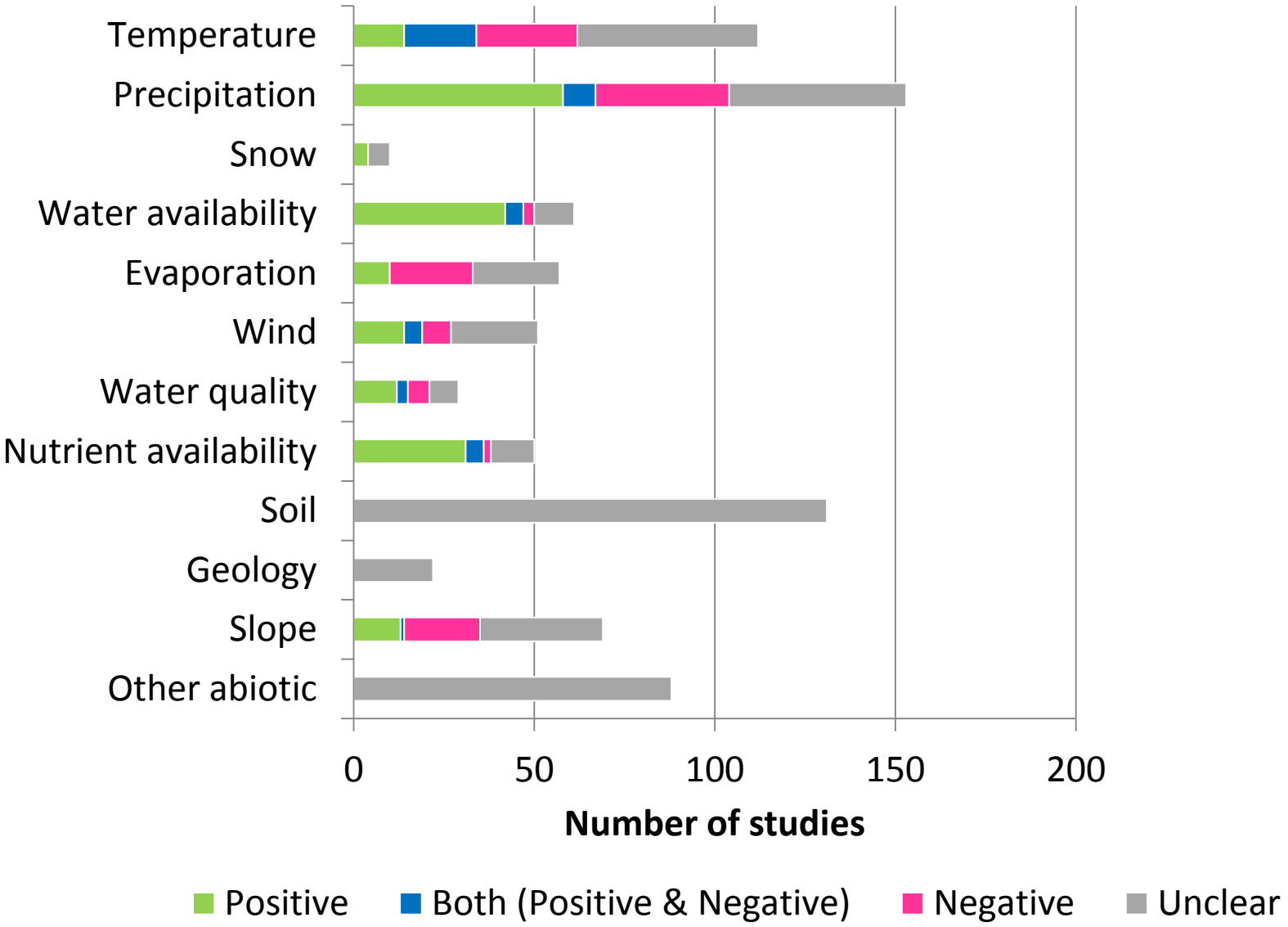
Alison Smith, ECI
and Paula Harrison, CEH
presented by Laurence Jones, CEH


Natural capital
Ecosystem service providers (ESPs)
Entire community or habitat
Functional group
Species
Biotic attributes
Habitat area, age, structure, etc.
Abundance of functional group
Species abundance, size, etc.
Abiotic factors
Temperature, precipitation, wind, etc
Ecosystem services
Food crops
Water
Freshwater fish
Timber
Atmospheric reg.
Air quality reg.
Water flow reg.
Mass flow reg.
Water quality reg.
Pollination
Pest control
Recreation
Aesthetic landscapes

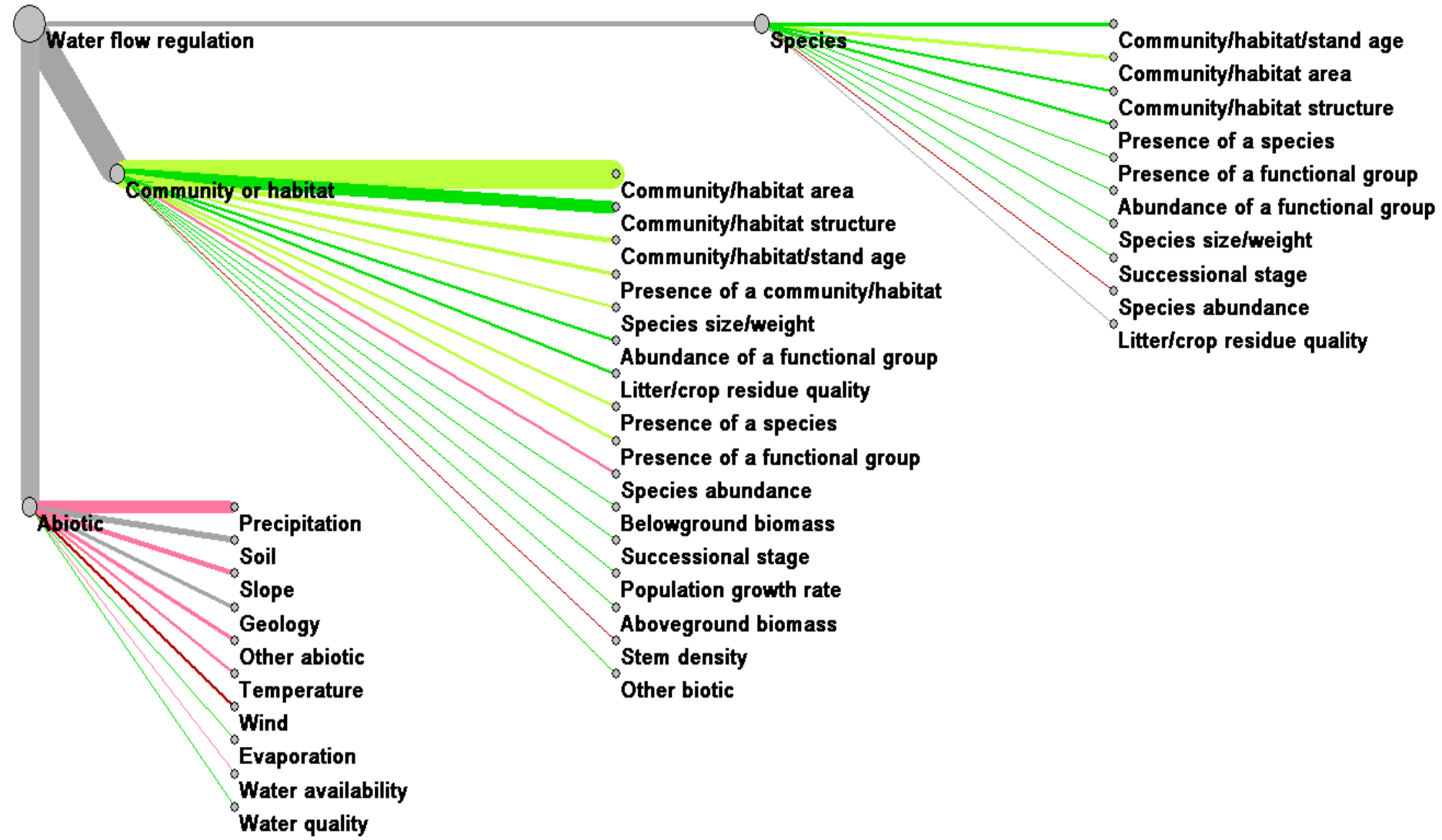
Biotic attributes



Abiotic factors

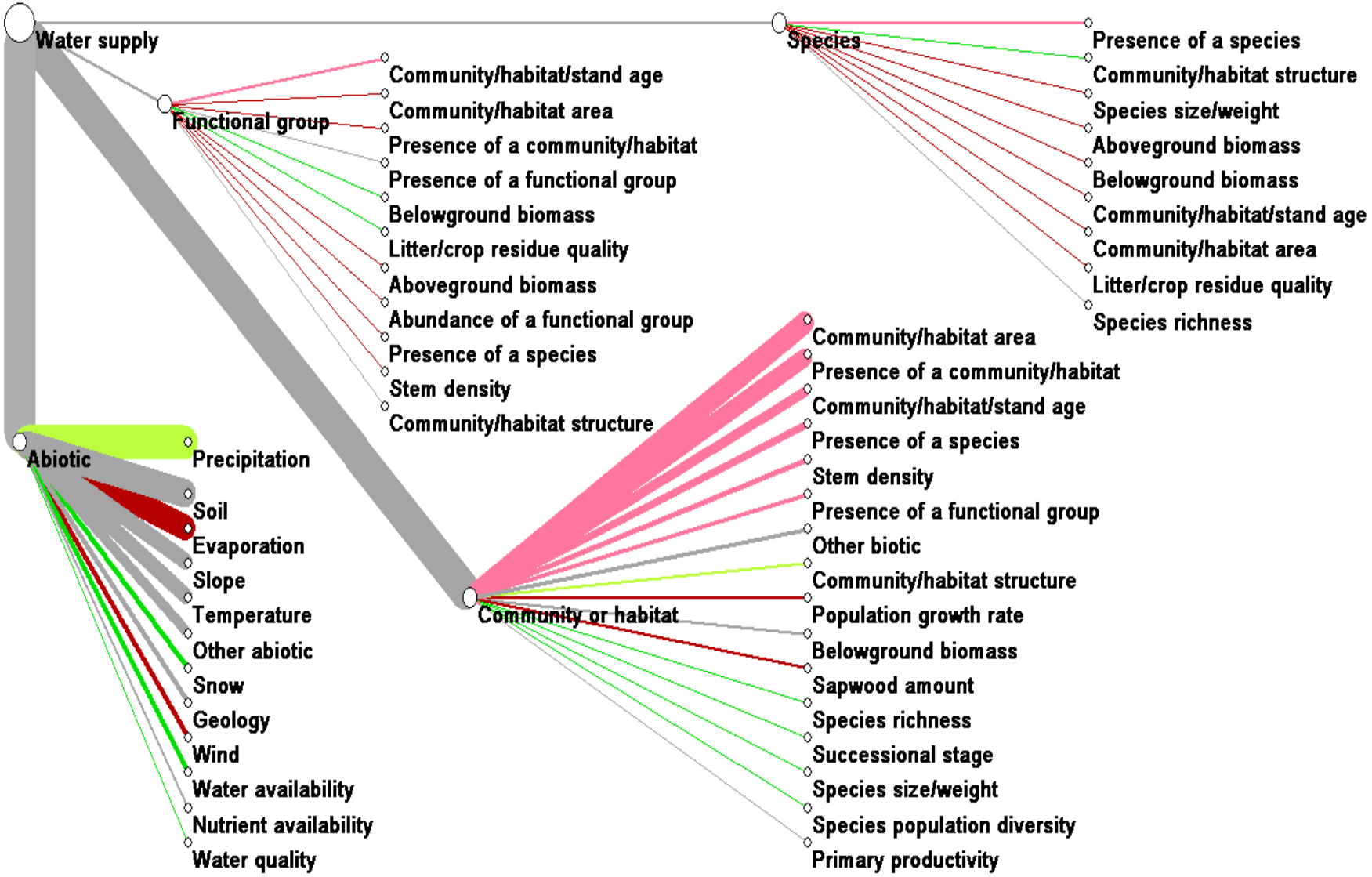


Water flow regulation
(flood protection)



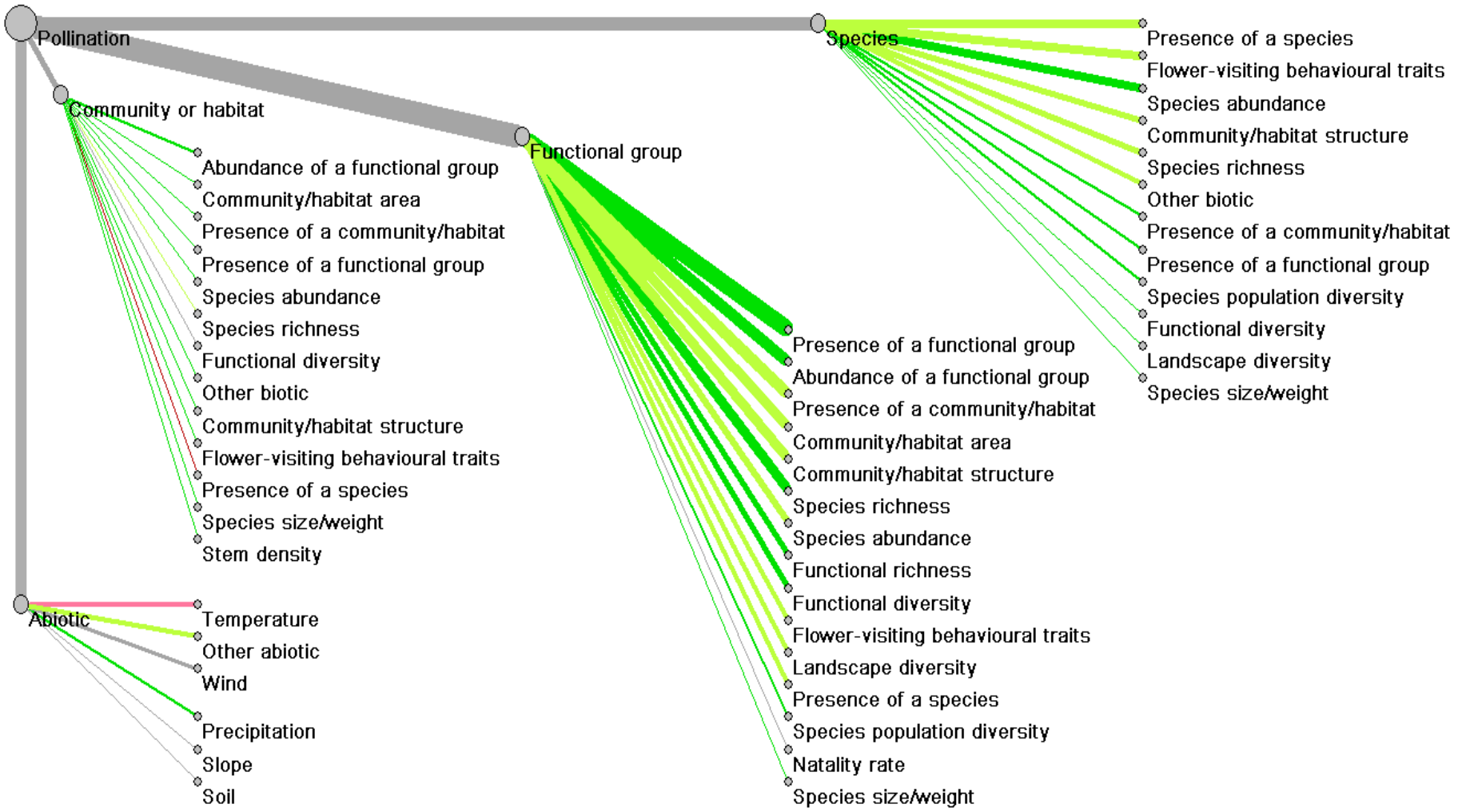
Line thickness is proportional to number of papers

Water supply



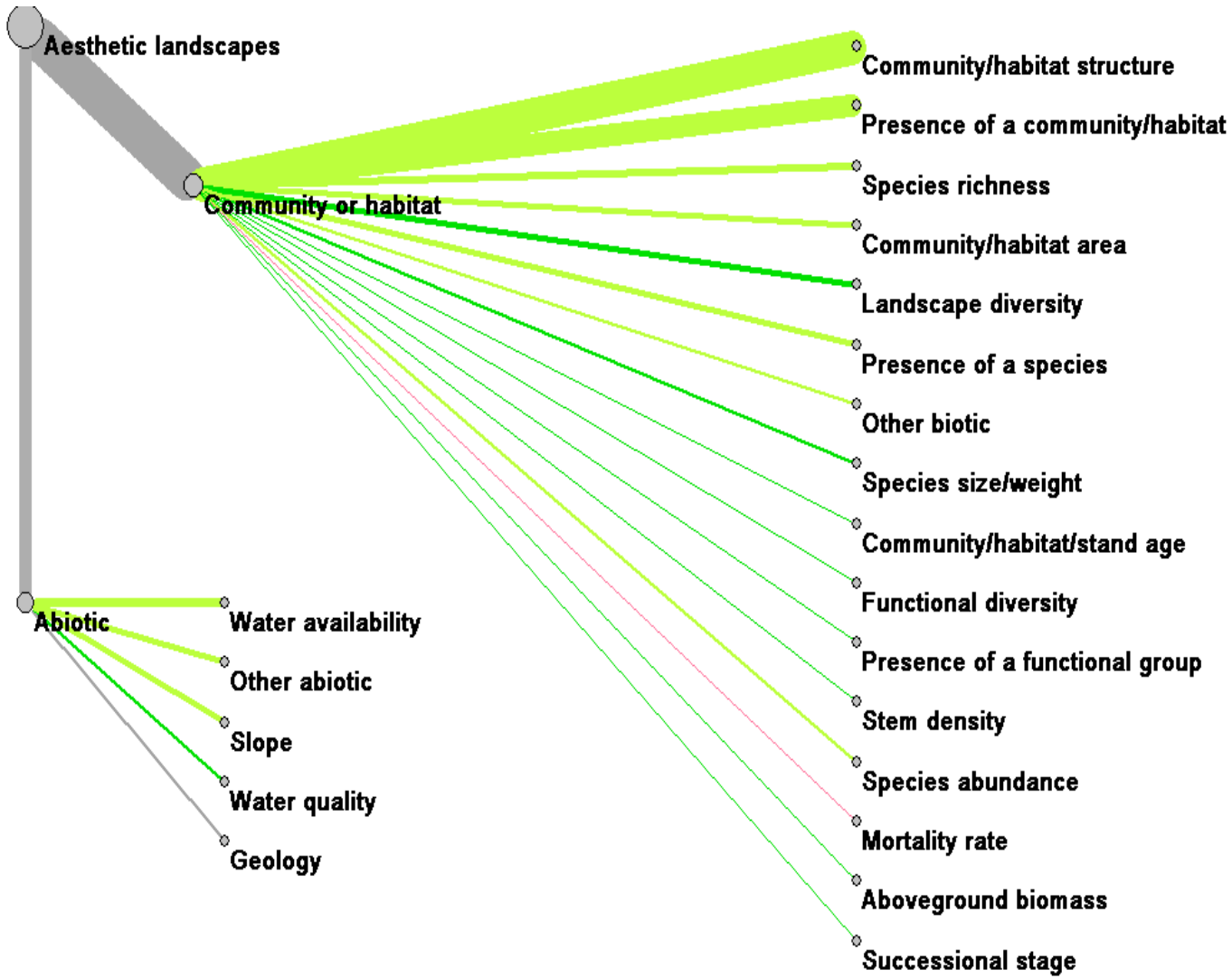
Line thickness is proportional to number of papers

Pollination



Line thickness is proportional to number of papers

Aesthetic landscapes



Line thickness is proportional to number of papers

Biotic attributes: positive

	Presence of a community/habitat	Community/habitat area	Community/habitat structure	Community/habitat/stand age	Successional stage	Primary productivity	Aboveground biomass	Belowground biomass	Stem density	Litter/crop residue quality	Landscape diversity	Species richness	Functional richness	Functional diversity	Presence of a functional group	Abundance of a functional group	Presence of a specific species	Species abundance	Species population diversity	Species size/weight	Population growth rate	Life span/longevity	Mortality rate	Wood density	Flower-visiting behavioural traits	Predator behavioural traits	Other biotic
Freshwater fishing	12	12	10		1	6	1			2	5	8	1	1	4	2	16	17	4	21	6	1	1				
Timber production	1		7	2	1	1	2		7	3		35	5	9	6		18	7		4	2						
Water supply	8	7	5	2	1			2	1	1		1			2		1		1	1							1
Food production (crops)	1	4	2				11	8		10	1	35	4	5	23	9	19		11	1	7						
Air quality regulation	5	27	4	1		2	5		1			4	1	1	12	3	15	2	1	9		1					18
Atmospheric regulation	12	17	14	18	8	9	35	25	2	6		16	2	8	6	8	15	4	5	12	8	2		6			1
Water flow regulation	5	41	21	10	2		1	2		2					4	3	3	1		3	1						1
Mass flow regulation	34	31	28	5	8	1	11	21	8	14		7	3	7	22		20	1		3	7						1
Water quality regulation	40	37	8	3	1	3	5	5	4	3		6	1	3	7	4	17	6	2	6	1						
Pollination	22	15	19						1		8	25	10	11	32	21	17	20	7	3					15		4
Pest regulation	17	20	22	1	2	1	2		1	5	5	9	8	7	10	13	4	11	1	1	3	2				11	5
Recreation (species-based)	4	3										18	1	3	7	5	43	15	10	10							6
Aesthetic landscapes	26	7	34	2	1		1		2		7	8		2	1		5	2		3							3

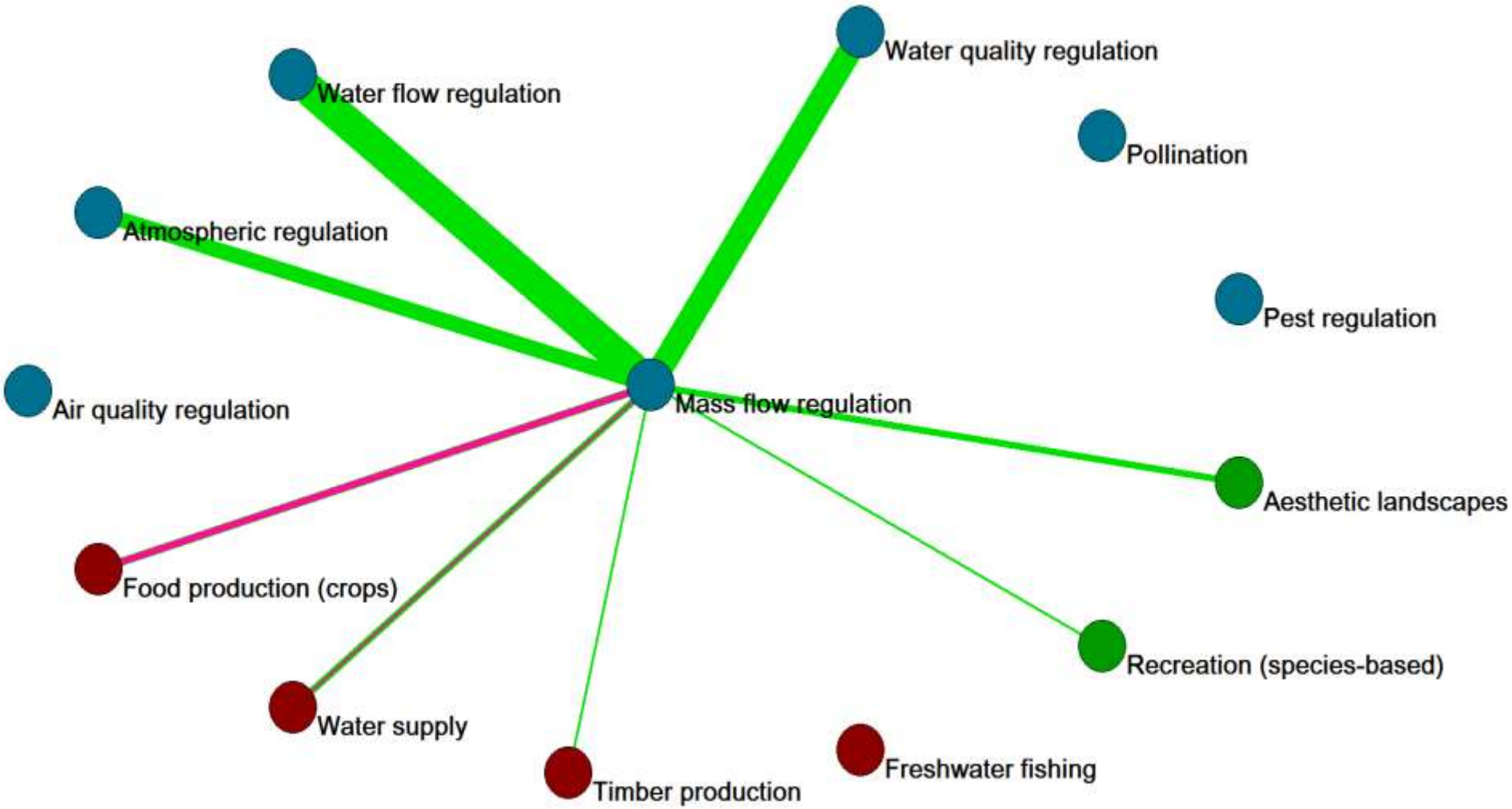
Biotic attributes: negative

	Presence of a community/habitat	Community/habitat area	Community/habitat structure	Community/habitat/stand age	Successional stage	Primary productivity	Aboveground biomass	Belowground biomass	Stem density	Litter/crop residue quality	Landscape diversity	Species richness	Functional richness	Functional diversity	Presence of a functional group	Abundance of a functional group	Presence of a specific species	Species abundance	Species population diversity	Species size/weight	Population growth rate	Life span/longevity	Mortality rate	Wood density	Flower-visiting behavioural traits	Predator behavioural traits	Other biotic
Freshwater fishing												1					1			1			14				
Timber production			1		3				4			5	1	2	3	1							2				
Water supply	20	26		12			2	2	9	1					5	1	10			2	5						1
Food production (crops)								1				1			1		2						1				
Air quality regulation							1								1								2				3
Atmospheric regulation			1				2					1		1			2					1	8				1
Water flow regulation	1	3		1					1						1		1	3		1							
Mass flow regulation	1		1	1	2										2		2			2							
Water quality regulation				2	1					1						1	1			2							
Pollination		1															2	2									
Pest regulation			2				1																2				1
Recreation (species-based)												2						5	1				5				
Aesthetic landscapes			1														1	1					1				

How NC provides ES

- **Physical amount of vegetation** within an ecosystem (e.g. habitat area, vegetation productivity, above- and below-ground biomass, species size/weight): important for water flow, water quality, carbon storage etc.
- **Characteristics of particular species or functional groups** (e.g. species size, predation behaviour)
- **Habitat type**: food and shelter to support ESP species
- **Diversity-related indicators** (species richness, species population diversity, functional richness/diversity, structural complexity and landscape diversity): e.g. through niche complementarity or resistance to disease.

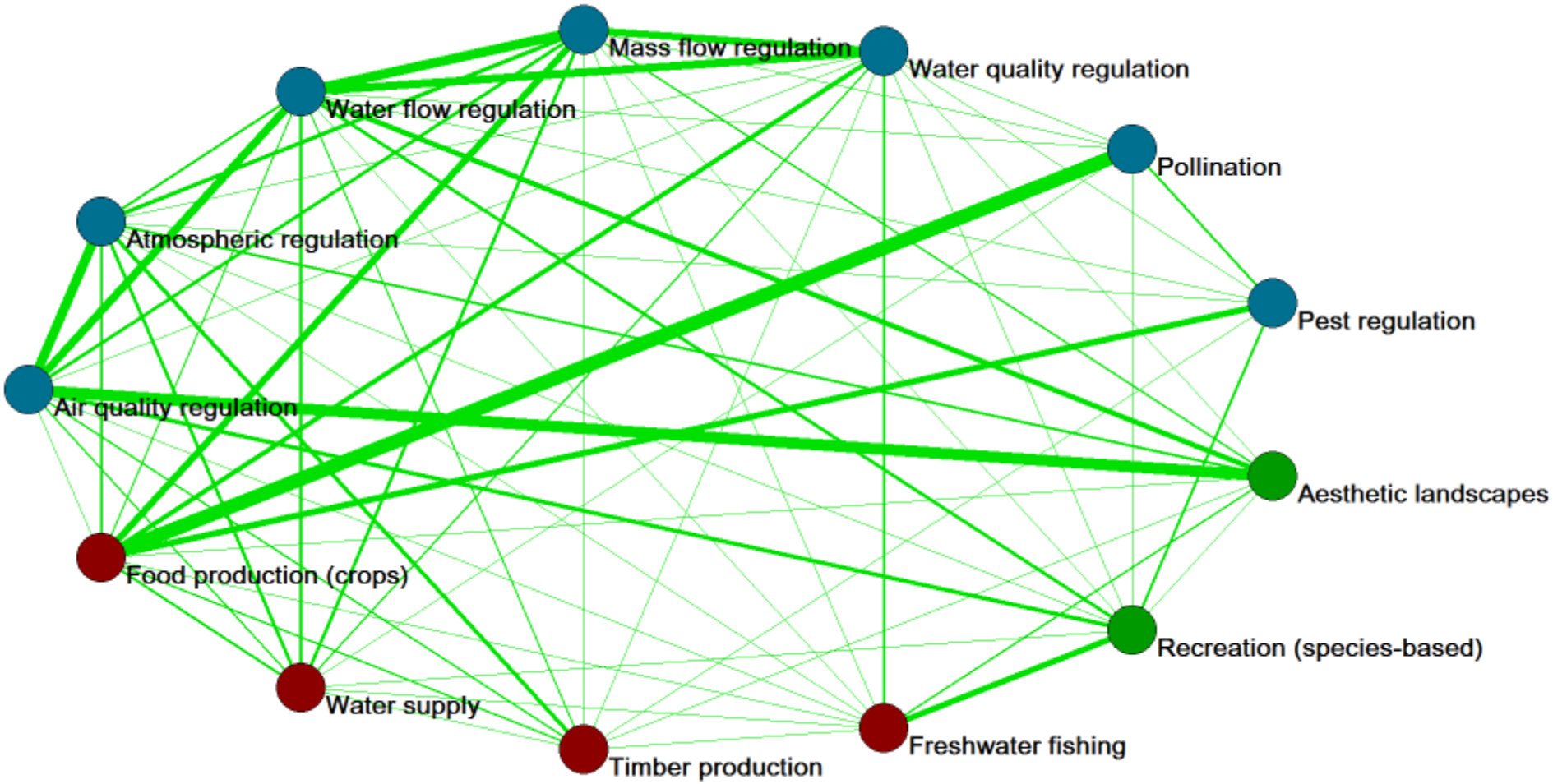
Interactions: mass flow regulation



Positive
Negative
Mixed

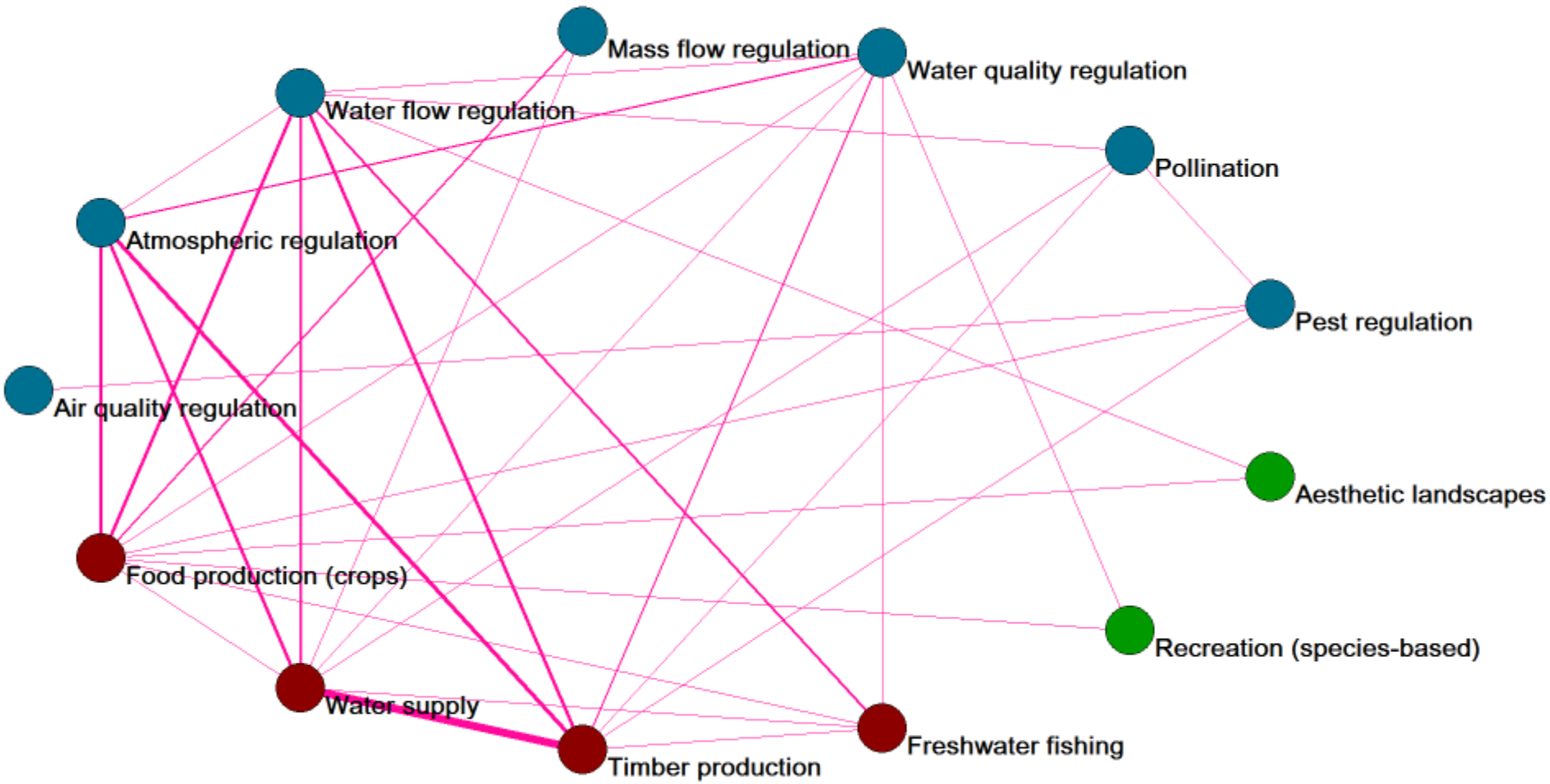
Line thickness is proportional to number of papers

Interactions: positive



Line thickness is proportional to number of papers

Interactions: negative



Line thickness is proportional to number of papers

Conclusions

There is a large but fragmented evidence base on the way in which natural capital underpins delivery of ES.

Four groups of biotic attributes were identified:

- Physical amount of vegetation
- Characteristics of particular species or functional groups
- Habitat types suitable for supporting ESPs
- Diversity

Many of the interactions between ES are positive: ecosystems can provide multiple benefits.

But there can be trade-offs, especially between provisioning services and regulating or cultural services: these require careful management.

Thank you

Evidence gaps and research needs

- Impact of ecosystem condition on ecosystem service delivery
- Biophysical thresholds beyond which ES delivery is compromised
- Role of functional diversity in delivering services and providing resilience to change
- Synergies and trade-offs between services, and the implications for land use management
- How well-designed management and related policies can protect and enhance ecosystem services and build resilience to change.